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PUBLIC PENSIONS AND PERSONAL SAVING: CANADIAN EVIDENCE IN THE EXTENDED LIFE CYCLE MODEL

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PUBLIC PENSIONS AND PERSONAL SAVING: CANADIAN EVIDENCE IN THE EXTENDED LIFE CYCLE MODEL

Taxation and Fiscal Policy Branch
Ministry of Treasury, Economics, and
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PREFACE

This paper has been prepared as background material for the CPP-Subcommittee examining the financing of the Canada Pension Plan. The purpose of the paper is to investigate the impact Canada's public pension system, which includes the Canada and Quebec Pension Plans, has on personal saving.

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I. INTRODUCTION

A number of recent economic studies have explored the impact public pension systems have on life cycle saving behaviour. Though empirical results using both time series and cross-section data have been contradictory, economic theory and econometric evidence indicate the social security programs designed to provide retirement income have the potential to lower rates of private and personal saving (Barro, 1977; Barro and MacDonald, 1977; Feldstein, 1974a, 1974b; Munnell, 1974).

This paper presents the results of employing an extended life cycle model to investigate the impact Canada's system of public pensions has on personal saving. The evidence to be presented reveals that public pensions in Canada both discourage and encourage saving. Taking into account the opposing influences, the overall or net impact of Canada's public pension system on personal saving has been negative. Depending upon model specification, public pensions are estimated to have reduced the rate of personal saving by as little as 0.182 percentage points to as much as 5.028 percentage points. Further, the statistical evidence suggests that while the Old Age Security program has a negligible impact on saving, the Canada and Quebec Pension Plans have reduced the personal saving rate by 4.773 percentage points.

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II. THE MODEL

To investigate the impact public pensions have on personal saving behaviour in Canada, a two equation extended life cycle model developed by Feldstein to explain differences in international rates of private saving was adopted (Feldstein, 1974b). This model was selected for three reasons. First, it explicitly distinguishes the two countervailing influences social security retirement programs are expected to have on life cycle saving behaviour: a negative wealth substitution effect and a positive induced retirement effect. The wealth effect discourages saving because public pension plans, represented in Canada by the OAS, GIS, CPP and QPP programs, allow households to substitute social security wealth (in the form of guaranteed pension benefits) for personal savings accumulated to provide income during retirement. Simultaneously, the presence of guaranteed public pensions induces retirement among the aged and increases the expectation of retirement among the members of the working population. The increased likelihood of retirement encourages personal saving[1].

Second, the model permits the estimation of the net impact of the two countervailing effects. Though the presence of the wealth substitution and induced retirement effects can be deduced from economic theory, it cannot be ascertained which dominates. This remains an empirical question.

And third, the model avoids the problems and uncertainties of using a constructed social security wealth time series. In particular, since no private wealth data are available for the Canadian household sector, the model circumvents the possibility that a constructed social security wealth series would only be acting as a proxy for private wealth. Instead of directly estimating the impact social security has on personal saving with a constructed wealth variable (Munnell, 1974; Feldstein, 1974a), its impact is indirectly estimated by relating the benefit structure of public pension plans to the rate of personal saving.

(i) The Wealth Substitution Equation

The first equation makes the rate of personal saving a function of five variables embodying factors that affect saving under the extended life cycle hypothesis. Equation (1) will be refered to as the wealth substitution equation and is specified as:

$$PSR = a_o + a_1\ YDR + a_2\ ADR + a_3\ RET + a_4\ CVG + a_5\ \left(\frac{B}{Y}\right) + a_6\ UR + e_1$$

where

PSR = ratio of personal saving (less farm inventories) to personal disposable income;

Y = real per capita personal disposable income;

YDR = ratio of population aged 0 - 19 to population aged 20 - 64;

ADR = ratio of population aged 65+ to population aged 20 - 64;

RET = measure of retirement expectations;

B = real government public pension benefits per aged eligible individual (thus $(\frac{B}{Y})$ can be considered a replacement rate);

CVG = ratio of aged population eligible for government benefits to population aged 65+; and,

UR = unemployment rate

The dependency variables ADR and YDR are included because the rate of personal saving is expected to be inversely related to the number of young and old non-productive individuals relative to the number of individuals in the productive years 20 to 64 (Leff, 1959). Supporting the consumption of young dependents from birth to the time they are productively employed reduces household saving out of disposable income. The more dependents, the greater the impact on saving. Also a decreasing YDR is symptomatic of an aging population. As a population ages, an increasing percentage will be in the middle and pre-retirement age groups which, under the life cycle hypothesis, have the highest propensity to save. This reinforces the inverse relationship between YDR and the personal saving rate.

Aged individuals, being generally less productive and thus having less income, support themselves by devoting increasingly larger portions of their income to consumption. As the number of aged individuals increase relative to the number of individuals aged 20 to 64, the lower will be the aggregate personal saving rate. The sign of the ADR variable should be negative.

The RET variable measures retirement expectations. The greater the expectation of retirement, the more an individual will save over his working lifetime. The wealth accumulated will provide income during retirement. The estimated coefficient of the RET variable should be positive.

The CVG and $(\frac{B}{Y})$ variables are included to estimate the direct impact government public pension plans have on personal saving. An increase in public pension benefits relative to per capita disposable income, $(\frac{B}{Y})$, is expected to reduce saving. In the presence of guaranteed benefits, it is not necessary for individuals to save as much over their working lives in order to provide themselves with a desired income stream during retirement. The lower rate of saving signifies the substitution of public wealth for private wealth.

With the public pension replacement rate held constant, an increase in the portion of the aged population covered by public pension plans, CVG, should also reduce saving. Increased coverage not only extends guaranteed benefits to more individuals, it also lengthens the period over which guaranteed benefits are paid if the extended coverage involves a reduction in the official age of eligibility. Consequently, individuals can reduce their rate of saving and still enjoy the same level of planned consumption during retirement.

Finally, the unemployment rate, UR, is included to adjust for the cyclical relationship between saving and income. An increase in the unemployment rate is expected to lower the saving rate as households attempt to maintain a stable consumption pattern over the business cycle.

(ii) The Induced Retirement Equation

The induced retirement equation is specified as:

$$RET = b_0 + b_1 Y + b_2 CVG + b_3 \left(\frac{B}{Y}\right) + e_2 \qquad (2)$$

The coefficient of Y is expected to be positive. This indicates that high levels of real per capita disposable income permit life cycle savers to accumulate wealth over their working life; in turn, the accumulated wealth provides income for retirement.

The parameters of $\left(\frac{B}{Y}\right)$ and CVG indicate the extent government public pension plans have themselves influenced the retirement expectations of the working population. If public pension plans induce retirement and increase expectations of retirement, the coefficients of the two variables will be positive.

(iii) Net Impact Equation

From the two structural equations, a reduced form equation embodying both the wealth substitution effect and the induced retirement effect can be derived. Estimating the reduced form equation is a convenient method of determining the net impact public pension plans have on the rate of personal saving in Canada.

The specification of the reduced form, or net impact equation is:

$$PSR = (a_0 + \overset{+}{a_3}\overset{}{b_0}) + \overset{-}{a_1}\ YDR + \overset{-}{a_2}\ ADR + \overset{+\ +}{a_3 b_1} Y$$
$$+ (\overset{+\ +}{a_3 b_2} + \overset{-}{a_4})\ CVG + (\overset{+\ +}{a_3 b_3} + \overset{-}{a_5})\ (\tfrac{B}{Y}) + \overset{-}{a_6}\ UR + e_3 \qquad (3)$$

It is instructive to note the a priori expectations about the signs of the net impact equation's coefficients. From the sign pattern, the net impact public pension plans have on the personal rate of saving is clearly indeterminate. This is because the coefficients embody the countervailing influences public pension plans have on saving. For example, the reduced form coefficient of CVG includes the parametric product $\overset{+\ +}{a_3 b_2}$. This measures the indirect positive impact increased public pension coverage has on personal saving through induced retirement. The remaining parameter, $\overset{-}{a_4}$, measures the direct negative impact of extended coverage through wealth substitution. The net impact CVG has on personal saving depends upon the absolute magnitudes of $\overset{+\ +}{a_3\ b_2}$ and $\overset{-}{a_4}$.

If the net impact of Canada's public pension system on personal saving has been negative with respect to either coverage or the replacement rate, that is the wealth substitution effect has dominated the induced retirement effect, then the corresponding reduced form parameters $(\overset{+\ +}{a_3\ b_2} + \overset{-}{a_4})$ and $(\overset{+\ +}{a_3\ b_3} + \overset{-}{a_5})$ will be negative. Conversely, if either $(\frac{B}{Y})$ or CVG have had a positive net impact on personal saving, their reduced form parameters will be positive.

Because income affects saving indirectly through its positive impact on the retirement expectations, and retirement expectations in turn positively affect personal saving, the coefficient of Y, $\overset{+}{a_3}\ \overset{+}{b_1}$, should be positive.

Finally, since the parameters of the dependency variables and the unemployment rate are unaffected by the derivation of the net impact equation, the expected signs of their parameters remain unchanged.

III. SIX ESTIMATED MODELS

Using the above formulation of the extended life cycle hypothesis as a foundation, six models were estimated to measure the impact Canada's public pension system has on personal saving. The six models can be conveniently divided into three sets. Each set is characterized by its method of specifying the benefit structure of Canada's public pension system.

Models 1 and 2 calculate benefit replacement rates using aggregate OAS, GIS, CPP and QPP expenditures. No attempt is made to separate the different impacts the programs may have on personal saving. Models 3 and 4 combine actual OAS and CPP/QPP annual retirement benefit levels to calculate replacement rates. This effectively treats the OAS and CPP/QPP as a single public pension plan. The final

two models evaluate the impact of the OAS and CPP/QPP programs separately. Their replacement rates are also computed using annual retirement benefits levels.

For statistical and theoretical reasons, only Models 1 and 2 allow the estimation of the two structural equations as well as the reduced form equation. Estimation problems are discussed as individual models are presented. Sources of data are in Appendix A.

(i) Model 1

Table 1 presents the estimated structural and reduced form equations of the hypothesized extended life cycle model. Before examining the estimated equation, it is necessary to describe the data employed.

(a) The Data

Since the true retirement expectations of the working population (RET) are unobservable, it was necessary to use a proxy variable. The percentage of males 65 years and over not participating in the labour force was selected to represent RET. Because there is no reason to believe the retirement expectations of the working population are identical to the observed retirement practices of the concurrent aged population, this variable is subject to measurement error.

To obtain the public pension replacement rate $(\frac{B}{Y})$, real benefits paid per eligible individual were first calculated by dividing total annual real benefits paid by the OAS, GIS, CPP and QPP programs by the number of eligible beneficiaries. This figure was in turn divided by real per capita disposable income to arrive at $(\frac{B}{Y})$.

The extent of coverage, CVG, is estimated by dividing the number of individuals at or above the age of eligibility for public pension benefits by the number of individuals 65 years of age and older. From the introduction of the universal OAS in 1952 to 1965 the age of eligibility was 70. In each of the five years subsequent to 1965, the eligible age for public pension benefits was reduced by one year. At present, the age of eligibility is 65[2].

Of the two variables which indirectly represent social security wealth, the replacement rate variable, $(\frac{B}{Y})$, is most subject to measurement error. First, the calculated value of $(\frac{B}{Y})$ underestimates the true aggregate replacement rate. Numerous programs which must be expected to affect saving and retirement behaviour are not represented. These include: pensioner income tax exemptions, property and pensioner tax credits administered by various provinces, exemptions from health care premiums, free prescription drugs and provincial income maintenance programs such as GAINS in Ontario and MINCOME in British Columbia. Second, the calculation of B, real govern-

ment public pension benefits per aged eligible individual, does not distinguish among the different public pension benefit structures. The OAS provides flat-rate pension demogrants; the GIS delivers income-tested pensions; and the CPP and QPP provide earnings-related, fully indexed pensions, which for a period of time were earnings-tested. Different benefit structures will produce different behavioural responses. For example, the income-tested GIS program would have a much greater effect on retirement than would the earnings-related CPP and QPP. A third source of measurement error is that the calculated replacement rate does not take account of future levels of CPP benefits which are significantly higher than the average benefit in-pay in the early years of the program. The $(\frac{B}{Y})$ variable measures an immature CPP benefit structure, when it is the mature benefit structure that affects life cycle saving behaviour.

The youth and aged dependency ratios (YDR, ADR) were calculated by dividing the number of individuals aged 0 - 19 and the number of individuals age 65 and over by the population aged 20 to 64. UR measures the annual unemployment rate of the civilian labour force.

Real per capita figures were obtained by dividing variables in current dollars by population and the Consumer Price Index (1971 = 100). Note that all ratios are expressed as percentages.

PUBLIC PENSIONS AND PERSONAL SAVING: MODEL 1 — TABLE 1

Wealth Substitution Equation (2SLS)

$$(1.1)\quad PSR = \underset{(-0.059)}{-0.449} \underset{(-5.261)}{-0.313\ YDR} + \underset{(3.163)}{0.580\ \widehat{RET}} \underset{(-2.994)}{-0.152\ CVG} \underset{(0.288)}{+0.037\ (\frac{B}{Y})} \underset{(-2.359)}{-0.408\ UR}$$

$R^2 = 0.851$ DW = 1.650 SER = 0.905 PD: 1953-75

Induced Retirement Equation (OLS)[1]

$$(1.2)\quad RET = \underset{(10.937)}{41.102} \underset{(3.702)}{+0.0053Y} \underset{(2.561)}{+0.122\ CVG} \underset{(3.104)}{+0.232\ (\frac{B}{Y})}$$

$R^2 = 0.976$ DW = 1.776 SER = 0.908 PD: 1953-75

Net Impact Equation (OLS)

$$(1.3)\quad PSR = \underset{(2.819)}{30.327} \underset{(-1.108)}{-1.154\ ADR} \underset{(-2.366)}{-0.191\ YDR} \underset{(4.188)}{+0.0045\ Y} \underset{(-2.410)}{-0.079\ CVG} \underset{(2.185)}{+0.125\ (\frac{B}{Y})} \underset{(-2.334)}{-0.488\ UR}$$

$R^2 = 0.768$ DW = 2.188 SER = 1.239 PD: 1946-76

Parentheses contain t-statistics.

1. Equation corrected for autocorrelation using Hildreth-Lu Method.

(b) Estimates of the Structural Equations

The structural equations were estimated over the 23 year period 1953 to 1975. Estimates of the retirement variable, RET, are not available before 1953 and with the change in the Labour Force Survey, consistent annual estimates are not available after 1975.

The estimated parameters of the wealth substitution equation (1.1), with the exception of the coefficient of $(\frac{B}{Y})$, are consistent with the predictions of the hypothesized model. The parameters, again with exception of the coefficient of the public pension replacement rate, are significant at the 5.0 per cent level. Because of the lack of variation in the aged dependency variable over the observation period, it was necessary to drop ADR from the regression.

The coefficient of RET (0.580) reveals the importance of taking retirement expectations into account when analyzing saving behaviour. A 1.0 percentage point increase in retirement expectations (a 1.0 percentage point decrease in the labour force participation rate of men over 65) produces a 0.580 percentate point increase in the rate of personal saving. This indicates that the impact of the retirement phenomenon on personal saving in Canada has been substantial.

The statistical significance of CVG and the statistical insignificance of $(\frac{B}{Y})$ suggest that the sole aspect of public pension plans that has directly affected saving behaviour is the extent of coverage. A 1.0 percentage point increase in coverage is estimated to reduce the personal saving rate by 0.152 percentage points, while no effect is statistically attributed to changes in the aggregate replacement rate. With the acceptance of the life cycle hypothesis, it would be unreasonable to conclude from this that the replacement rate of public pension plans do not affect personal saving. To do so implies that even if the replacement rate is increased to 100 per cent, there would be no negative impact on saving. An explanation of the statistical insignificance of the $(\frac{B}{Y})$ variable in the wealth substitution equation must be found elsewhere.

One explanation is that improvements in public pension plans have not been continuous, but the product of two discrete policy initiatives involving simultaneous changes in both coverage and benefits. Though $(\frac{B}{Y})$ does exhibit year-to-year variation, most of the variation reflects changes which served to maintain an established aggregate replacement rate rather than changes intended to increase it. As a consequence, most of the year-to-year variation would not affect saving[4]. On the two occassions when the replacement rate of public pensions was purposely increased, in 1952 with the introduction of the OAS and 1967 with the first payments under the GIS, CPP and QPP, the increase was accompanied by an expansion in coverage. Under these circumstances, the

estimation technique cannot attribute statistical significance to both CVG and $(\frac{B}{Y})$. The effect coverage has on saving is statistically significant because its pattern of variation most reflects the two shifts in public pension policy.

The estimated induced retirement equation confirms the hypothesis that higher levels of real income and social security retirement benefits increase retirement among the aged. With respect to income, the equation indicates that over the observation period a $100 increase in real per capita disposable income increased the rate of retirement by about 0.5 percentage points.

The statistical significance of the variables representing Canada's social security retirement programs reveal that benefits paid under public pension plans have induced retirement and increased retirement expectations. Regression (1.2) indicates that a 1.0 percentage point increase in coverage or a 1.0 percentage point increase in the aggregate replacement rate induce retirement among the aged by 0.122 and 0.232 percentage points. respectively.

The fact that the public pension replacement rate variable is significant in the induced retirement equation while insignificant in the wealth substitution equation is not surprising. The induced retirement equation

is in effect an equation measuring the labour force participation of the aged. Small year-to-year variations in $(\frac{B}{Y})$ intended to maintain an established real pension would not affect life cycle saving behaviour, but would affect the need for aged individuals to seek employment to support their consumption pattern.

(c) Estimate of the Net Impact Equation

The net impact equation was estimated over the observation period 1946-1975. It was possible to expand the sample size by eight observations because the retirement variable, RET, does not appear in the reduced form specification. The additional variation in the increased sample size allowed the re-introduction of the aged dependency variable (ADR). Its coefficient possesses the expected sign under the life cycle saving hypothesis.

As expected, the coefficients of real per capita disposable income are positive. The income parameter of regression (1.3) indicates that a $100 increase in real income raises the personal saving ratio by 0.45 percentage points. This is the indirect effect income has on saving through its impact on retirement expectations.

The very significant negative coefficient of the public pension variable CVG reveals that with respect to the extent of coverage, the wealth substitution effect has

dominated the induced retirement effect. The net impact of a 1.0 percentage point increase in coverage of the aged population is a 0.079 percentage point reduction in the personal saving rate.

The positive coefficient of $(\frac{B}{Y})$ implies that with respect to the public pension replacement rate, the induced retirement effect has dominated the wealth substitution effect. This is not too surprising for two reasons. First, as discussed in the preceding section, the contemporaneous changes in public pension coverage and replacement rates make it difficult to attribute statistical significance to any negative effect $(\frac{B}{Y})$ has on personal saving. Second, regression (1.2) shows that the aggregate replacement rate has contributed significantly to inducing retirement and raising retirement expectations, which in turn encourage increased saving. Since Canada's public pension system is promoted as providing a <u>minimum level</u> of retirement income, households would regard public pension replacement rates as a goal to be exceeded through a marked increase in personal saving. The consequence of a statistically weak substitution effect and a strong induced retirement effect is a positive and statistically significant reduced form coefficient.

Though the positive coefficient of $(\frac{B}{Y})$ implies that an increase in the aggregate replacement rate would raise the saving rate, it would be incorrect to use this

result to forecast the impact of an increase in public pension benefits. Without further lowering the eligible retirement age, the upper limit on retirement expectations might soon be reached, if it has not been already, and any positive effect on personal saving would be minimal. Under this circumstance, the wealth substitution effect of increased replacement rate would dominate and the net impact on the personal saving rate would be negative.

(ii) Model 2

Model 2 provides an alternative approach to estimating the impact of public pensions plans on saving and retirement behaviour. Instead of defining $(\frac{B}{Y})$ as a replacement rate for only the eligible aged, it can be specified as a replacement rate for all the aged. Specifically, the replacement rate for all the aged is represented by $(\frac{B65}{Y})$, where B65 is real public pension plan benefits paid per individual aged 65 or older, and Y remains real per capita disposable income. In this way, the effects of changes in public pension plan coverage and replacement rates are embodied in one variable.

(a) Estimates of Structural Equations

Estimates of the structural equations are presented in Table 2. As with Model 1, the aged dependency variable (ADR) was dropped from the wealth substitution equation due to lack of variation over the observation period. The parameters of both structural equations have theoretically

PUBLIC PENSIONS AND PERSONAL SAVING: MODEL 2 — TABLE 2

Wealth Substitution Equation (2SLS)

$$(2.1)\quad PSR = \underset{(-1.474)}{-16.624} \underset{(-4.757)}{-0.206\ YDR} \underset{(3.247)}{+0.689\ \widehat{RET}} \underset{(-2.288)}{-0.307\ \left(\frac{B65}{Y}\right)} \underset{(-1.423)}{-0.276\ UR}$$

$R^2 = 0.776$ DW = 1.368 SER = 1.080 PD: 1953-75

Induced Retirement Equations (OLS)[1]

$$(2.2)\quad RET = \underset{(22.288)}{52.295} \underset{(3.696)}{+0.0048\ Y} \underset{(3.637)}{+0.287\ \left(\frac{B65}{Y}\right)}$$

$R^2 = 0.977$ DW = 1.815 SER = 0.881 PD: 1953-75

Net Impact Equation (OLS)

$$(2.3)\quad PSR = \underset{(2.226)}{25.998} \underset{(-1.141)}{-1.249\ ADR} \underset{(-1.222)}{-0.096\ YDR} \underset{(3.104)}{+0.0039\ Y} \underset{(-0.636)}{-0.032\ \left(\frac{B65}{Y}\right)} \underset{(-1.680)}{-0.372\ UR}$$

$R^2 = 0.715$ DW = 1.876 SER = 1.344 PD: 1946-76

Parentheses contain t-statistics.

1. Equation corrected for autocorrelation using Hildreth-Lu Method.

correct signs and are all statistically significant at least at the 10 per cent level.

The statistically significant and numercially large coefficients of $(\frac{B65}{Y})$ in the wealth substitution and induced retirement equations indicate the significant impact public pensions have on both saving and retirement behaviour. A 1.0 percentage point increase in the replacement rate increases the retirement expectations by 0.287 percentage points and decreases personal saving by 0.307 percentage points. But the increase in retirement expectations simultaneously raises the personal saving rate by (0.689 * 0.287 = 0.198) percentage points. The net impact of the 1.0 percentage point increase in $(\frac{B65}{Y})$ on personal saving is a reduction in thesaving rate of (-0.307 + 0.198 = -0.109) percentage points.

(b) Estimate of Net Impact Equation

Equation (2.3) is the statistically estimated reduced form of Model 2. The numerically small (-0.032) and statistically insignificant parameter of $(\frac{B65}{Y})$ indicates the negative wealth substitution and positive induced retirement effects have been in balance. This contrasts with the results of calculating the net impact of public pensions using the individually estimated structural equations. As noted above, the reduced form parameter of $(\frac{B65}{Y})$ calculated from the structural equations (-0.109) is three times the magnitude of its statistically estimated counterpart.

Comparing the estimated net impact equation of Model 1 with that of Model 2, reveals that the latter has relatively lower R^2 and Durbin-Watson statistics, a larger standard error of the regression, and generally larger standard errors of the parameters. This suggests there is a statistical cost to embodying the effects of public pension plans replacement rates and coverage in one variable.

(iii) Model 3 and Model 4

The preceding two models employed total OAS, GIS, CPP/QPP benefits in-pay to measure the replacement rate of public pension plans. The models estimated in this section calculate public pension replacement rates using the maximum annual OAS and CPP/QPP retirement benefits payable.

(a) Data

The new public pension replacement rate variable is $(\frac{MB}{Y})$. It is calculated by adding the annual OAS demogrant to the maximum annual CPP/QPP retirement pension payable. After dividing by the CPI, the real maximum benefit (MB) is divided by real per capita disposable income (Y).

Employing the sum of actual OAS and CPP/QPP retirement benefits to calculate the replacement rate can be supported by two arguments. First, since the CPP and QPP are new programs, their benefits per aged individual calculated from aggregate pension payments in the early years do not reflect benefits under mature pension system. Since it is mature pensions that undoubtedly affect wealth substitution and the retirement expectations of life cycle savers, then it is actual CPP/QPP benefit levels that should be reflected in the replacement rate variable. And second, the OAS and the CPP/QPP programs may be considered as one program. The annual OAS demogrant is simply interpreted as a flat-rate component of CPP/QPP unrelated to contributory history. As their combined benefits increase relative to per capita income they impact on the life cycle saving behaviour.

Finally, unlike the replacement rate variable used in Models 1 and 2, $(\frac{MB}{Y})$ excludes reference to the income-tested GIS program. If most saving is done by middle and upper-income households, it is unlikely that GIS benefits would enter into their life cycle saving behaviour and should therefore be eliminated from an indirect measure of social security wealth.

(b) Structural Equations

In estimating Models 1 and 2, it was assumed that the public pension variables which affected the retirement behaviour (labour force participation) of the aged could

also serve as indirect measures of social security wealth in the wealth substitution equation. This assumption, along with the assumption that RET was a satisfactory proxy for the true retirement expectations of the working population allowed the estimation of the structural equations.

Unfortunately, this is not the case with the new public pension replacement rate definition. As explained above $(\frac{MB}{Y})$ is calculated using actual OAS and CPP/QPP retirement benefit levels to more adequately reflect the public pension expectations of the working population. Since expected retirement benefits do not affect current retirement behaviour of the aged, the new replacement rate variable cannot explain the variation in RET, and in turn, RET is no longer acceptable as a suitable proxy for retirement expectations.

(c) Estimated Net Impact Equations

Though the construction of the public pension plan replacement rate prohibits the estimation of the hypothesized structured equations, there is no theoretical or statistical prohibition to the estimation of the reduced form equation. By substituting the induced retirement equation into the wealth substitution equation to obtain the reduced form, any explicit reference to the retirement expectations of life cycle savers is avoided.

PUBLIC PENSION AND PERSONAL SAVING: MODEL 3 — TABLE 3

(3.1) $PSR = 30.493 \underset{(2.788)}{} - 1.255\ ADR \underset{(-1.188)}{} - 0.157\ YDR \underset{(-2.071)}{} + 0.0039\ Y \underset{(3.801)}{}$

$- 0.102\ CVG \underset{(-2.292)}{} + 0.157 \left(\frac{MB}{Y}\right) \underset{(2.049)}{} - 0.541\ UR \underset{(-2.450)}{}$

$R^2 = 0.763$ DW = 2.203 SER = 1.252 PD: 1946-76

Parentheses contain t-statistics

PUBLIC PENSIONS AND PERSONAL SAVING: MODEL 4 — TABLE 4

(4.1) $PSR = 23.777 \underset{(2.177)}{} - 1.078\ ADR \underset{(-0.998)}{} - 0.107\ YDR \underset{(-1.417)}{} + 0.0043\ Y \underset{(3.261)}{}$

$- 0.043 \left(\frac{MB65}{Y}\right) \underset{(-1.034)}{} - 0.345\ UR \underset{(-1.568)}{}$

$R^2 = 0.723$ DW = 1.937 SER = 1.327 PD: 1946-76

Parentheses contain t-statistics

Table 3 presents the estimated net impact equation with $(\frac{MB}{Y})$ and CVG representing social security wealth. As in Models 1 and 2, CVG measures the percentage of the aged population covered by public pension benefits. The coefficients of CVG and $(\frac{MB}{Y})$ in equation (3.1) indicate the negative wealth substitution effect has dominated with respect to coverage and the positive induced retirement effect has dominated with respect to the public pension replacement rate.

Model 4 combines the measures of coverage and public pension replacement rate in a single variable. The new variable, $(\frac{MB65}{Y})$, is the product of multiplying CVG by $(\frac{MB}{Y})$. This effectively weights the expected replacement rate of public pensions by the extent of public pension coverage. The greater the coverage, the greater will be the impact of a change in the replacement rate. The variable $(\frac{MB65}{Y})$ is comparable to $(\frac{B65}{Y})$ introduced with Model 2.

The estimated reduced form of Model 4 is presented in Table 4. Though not statistically different from zero, the negative coefficient of $(\frac{MB65}{Y})$ is larger and has a smaller standard error than the indirect measure of social security wealth used in equation (2.3). The expected replacement rates reveals a relatively stronger wealth substitution effect than replacement rates calculated by averaging total public pensions in-pay.

(iv) Model 5 and Model 6

The final two models estimate the impact of the universal OAS and the CPP/QPP programs separately. This reflects the view that the two public pension systems serve different purposes and, as a consequence, affect personal saving behaviour differently. The OAS, being a modest income support program with the indigent aged as its target population, may not affect saving. In contrast, the CPP/QPP, being modeled after private sector final average plans, should affect life cycle saving behaviour of middle and upper-income households.

(a) Estimate of Net Impact Equation: Model 5

Table 5 presents the estimated net impact equation of Model 5. Three variables represent social security wealth. The replacement rates of the OAS and CPP/QPP pension systems are variables $(\frac{OAS}{Y})$ and $(\frac{CPP}{Y})$, respectively. The extent of public pension coverage is measured by CVG.

As in previous models which separate coverage from replacement rates, it is the estimated parameter of CVG which is negative and significantly different from zero. The statistically insignificant coefficient of $(\frac{CPP}{Y})$ suggests that with respect to the replacement rates of the CPP and QPP, the negative substitution effect and the positive induced retirement effect have been in balance. Interestingly, the coefficient of $(\frac{OAS}{Y})$, which is just significant at the 10 per cent level, is positive. This implies that the induced retirement effect associated with OAS benefits has dominated its corresponding wealth substitution effect.

PUBLIC PENSIONS AND PERSONAL SAVING: MODEL 5 — TABLE 5

$$(5.1)\ PSR = \underset{(2.713)}{30.241} \underset{(-1.120)}{-1.210}\ ADR \underset{(-1.925)}{-0.179}\ YDR \underset{(2.562)}{+0.0045}\ Y$$
$$\underset{(-1.541)}{-0.087}\ CVG \underset{(1.440)}{+0.135}\left(\frac{OAS}{Y}\right) \underset{(0.511)}{+0.090}\left(\frac{CPP}{Y}\right)$$
$$\underset{(-2.042)}{-0.500}\ UR$$

$R^2 = 0.765$ DW = 2.194 SER = 1.274 PD: 1946-76

PUBLIC PENSIONS AND PERSONAL SAVING: MODEL 6 — TABLE 6

$$(6.1)\ PSR = \underset{(2.481)}{28.703} \underset{(-1.077)}{-1.155}\ ADR \underset{(-1.863)}{-0.200}\ YDR \underset{(3.325)}{+.0055}\ Y$$
$$\underset{(-1.547)}{-0.142}\left(\frac{MCPP}{Y}\right) \underset{(-0.132)}{-0.007}\left(\frac{MOAS}{Y}\right) \underset{(-1.431)}{-0.314}\ UR$$

$R^2 = 0.738$ DW = 1.980 SER = 1.315 PD: 1946-76

(b) Estimate of Net Impact Equation: Model 6

A difficulty with the specification of Model 5 is that the coverage variable, CVG, constrains the impact of extending the coverage of the OAS and CPP/QPP programs to be equal. If they are distinctly different programs, the impact of extending their coverage would also be different.

In Table 6, the results of weighting the replacement rates of the OAS and CPP/QPP programs are presented. The variables $(\frac{MCPP}{Y})$ and $(\frac{MOAS}{Y})$ are the products of (CVG * $(\frac{CPP}{Y})$) and (CVG * $(\frac{OAS}{Y})$), respectively. Under this specification of the indirect measures of social security wealth, the OAS program is revealed to have no net impact on the personal saving rate. The coefficient of $(\frac{MOAS}{Y})$ is not only very small (-0.007), it is also statistically insignificant from zero.

In contrast, the negative and statistically significant estimated coefficient of $(\frac{MCPP}{Y})$ (-0.142) indicates that introduction of the CPP and QPP has lowered the rate of personal saving. With respect to the Canada and Quebec Pension Plans, the negative wealth substitution effect has dominated the positive induced retirement effect.

IV. IMPACT OF PUBLIC PENSIONS ON PERSONAL SAVING

The period over which public pensions have provided significant amounts of retirement income commenced in 1952 with the introduction of the universal Old Age Security Program[3]. In 1966 the public pension system was expanded with the introduction of the income-tested Guaranteed Income System and the earnings-related Canada

and Quebec Pension Plans. The various extended life cycle models developed in the previous section have examined the impact public pensions have on personal saving from a variety of perspectives. Using their net impact equations, a range of estimates of how Canada's public pension system have affected personal saving can be derived.

Table 7 summarizes the results. Over the period 1952-1965 when the OAS was the only public pension, its estimated impact ranges from increasing the personal saving rate by 0.937 percentage points to reducing saving by 1.373 percentage points. For the period 1966 to 1976, which was characterized not only by the introduction of the GIS and CPP/QPP programs, but also the lowering of the eligibility age from 70 to 65, each model estimates a net negative impact on personal saving. Depending upon model spedification, the expansion of Canada's public pension system is estimated to have reduced the personal saving rate by as little as 0.552 percentage points or by as much as 4.799 percentage points. Finally, estimates of the reduction in personal saving rate over the complete 25 year period ranges from 0.196 to 5.023 percentage points.

To put the estimated reductions of personal saving in perspective, they can be related to observed rates of personal saving. The personal saving rate in 1976 was 10.424 per cent. In the absence of Canada's public pension system, the estimates in Table 7 reveal that the

ESTIMATES OF NET IMPACT OF PUBLIC PENSIONS ON PERSONAL SAVING, 1952-1976 — TABLE 7

	1952-1965	1966-1976	1952-1976
Model 1	0.937	-2.680	-1.744
Model 2	-1.024	-0.552	-1.576
Model 3	0.976	-1.172	-0.196
Model 4	-1.373	-1.367	-2.740
Model 5	0.885	-2.507	-1.623
Model 6	-0.223	-4.799	-5.023

personal saving rate in 1976 would have ranged from a low of (10.424 + 0.196 = 10.620) per cent to a high of (10.424 + 5.023 = 15.447) per cent. In other words, Canada's overall public pension system is estimated to have reduced personal saving by as little as 1.8 per cent to as much as 32.5 per cent.

V. THE CPP/QPP AND PERSONAL SAVING

Either Model 4 or Model 6 can be used to estimate the impact the Canada and Quebec Pension Plans have had on personal saving since their introduction in 1966. Also, the coefficients of the two models allow the estimation of the effect on personal saving of an increase in the current CPP/QPP retirement benefit levels.

(i) Impact of CPP/QPP on Personal Saving, 1966-1976

Depending upon which of the two models is used, the introduction of the CPP/QPP is estimated to have lowered the personal rate of saving by either 1.367 percentage points or 4.814 percentage points. The large discrepancy in the estimates reflect the different assumptions made about the relationship between the CPP/QPP and the OAS programs, which in turn determined the calculation of the variables used to represent social security wealth.

Model 4 assumes the OAS and CPP/QPP can be treated as a single public pension program. In contrast, Model 6 assumes the two programs serve two distinct purposes. The OAS being a program primarily intended to support the indigent aged, and the CPP/QPP being a program which affects the saving of middle and upper-income households.

Tables 8 and 9 present the values of the explanatory variables used in the two models. By multiplying the change in these variables since the introduction of the CPP/QPP by their respective coefficients, the impact each has had on personal saving over the pariod can be estiated.

Under both specifications, the substantial increase in per capita disposable income has had, through the induced retirement effect, the most significant impact on saving. The $1,388 increase in real per capita income from 1965 to 1976 raised the personal saving rate by 5.968 percentage points under the assumptions of Model 4 and 7.634 percentage points under the assumptions of Model 6.

ESTIMATED IMPACT OF THE CPP/QPP ON PERSONAL SAVING (1966-1976)[1]					TABLE 8
Variable	YDR	ADR	Y	UR	$(\frac{MB65}{Y})$
1965	84.78	15.35	2293.18	3.92	31.92
1976	65.26	15.49	3681.19	7.14	63.72
Difference 1976-1965	-19.52	0.14	1388.01	3.22	31.80
Estimated Coefficient	-0.107	- 1.078	0.0043	-0.345	-0.043
Impact on Saving Ratio	2.089	-0.151	5.968	-1.111	- 1.367

1. Using Equation (4.1)

ESTIMATED IMPACT OF THE CPP/QPP ON PERSONAL SAVING (1966-1976)[1]					TABLE 9	
Variable	YDR	ADR	Y	UR	$(\frac{MOAS}{Y})$	$(\frac{MCPP}{Y})$
1965	84.78	15.35	2293.19	3.92	31.92	0.00
1976	65.26	15.49	3681.19	7.14	29.82	33.90
Difference 1976-1965	-19.52	0.14	1388.01	3.22	- 2.10	33.90
Estimated Coefficient	- 0.200	- 1.155	0.0055	-0.314	-0.007	- 0.142
Impact on Saving Ratio	3.904	-0.162	7.634	-1.011	0.015	-4.814

1. Using Equation (6.1)

Over the same period, if the CPP/QPP and OAS are viewed as a single program, the introduction of CPP/QPP retirement benefits reduced personal saving by 1.367 percentage points. If the programs are behaviourally distinct, the estimated reduction in the personal rate of saving is 4.814 percentage points.

Overall, both models indicate that the retirement phenomenon has increased the personal rate of saving which is consistent with the observed steady increase in the rate of personal saving since the mid-sixties. Under the assumptions of Model 4, the retirement phenomenon accounts for a (5.968-1.367 = 4.601) percentage point increase in personal saving. The corresponding estimate for Model 6 is (7.634-4.814 = 2.820) percentage points.

(ii) Impact of an Increase in the CPP/QPP Retirement Benefit

Currently the maximum CPP/QPP retirement benefit is equal to 25 percent of the final three year average of the contributory base (YMPE). In 1976 the maximum CPP/QPP retirement pension was $1858.33. Under the extended life cycle hypothesis, an increase in the Plan's retirement benefit would increase social security wealth and influence personal saving through the countervailing induced retirement and wealth substitution effects. Since the net impact equations of Models 4 and 6 employ actual public pension structures to indirectly represent social security wealth, they can be used to estimate the impact of an increase in CPP/QPP retirement benefits.

Table 10 presents the estimated impact of a 50 per cent increase in the maximum CPP/QPP retirement benefit. The increased maximum retirement benefit is calculated as 37.5 per cent of the three year final average of the contributory base. Under this benefit structure, the maximum 1976 annual CPP/QPP retirement benefit would have been $2,787.49. As recorded in Table 10, the $926.16 pension increase represents a 16.95 percentage point increase in the aggregate replacement rate of Canada's public pension system.

ESTIMATED IMPACT OF A 50 PER CENT INCREASE IN CPP/QPP RETIREMENT BENEFIT — TABLE 10

Benefit Variable	$(\frac{MB65}{Y})$ [1]	$(\frac{MCPP}{Y})$ [2]
Percentage Point Change due to Increased CPP Retirement Benefit	16.95	16.95
Estimated Coefficient	-0.043	-0.142
Estimated Impact on Saving Ratio	-0.729	-2.407

1. Specified in Model 4
2. Specified in Model 6

Again the estimated impact of the pension increase on personal saving depends upon the model used. If the OAS and CPP/QPP are behaviourally distinct, the 50 per cent increase in CPP/QPP retirement benefits would reduce the personal saving rate by 2.407 percentage points. If the two public pension programs are viewed as one, the estimated reduction in the personal saving rate is a more modest 0.729 percentage points.

VI. IMPACT OF PUBLIC PENSIONS ON TOTAL SAVING

Though the statistical evidence reveals public pensions reduce personal saving, it does not necessarily follow that Canada's total saving rate has been correspondingly reduced. The corporate, government and foreign sectors also save and it is possible that the reduction in personal saving may be offset by increased saving by these sectors.

A possible source of government saving are the partially funded Canada and Quebec Pension Plans. In 1976 the surplus of contributions over benefits paid was $1.168 billion, or 0.927 per cent of personal disposable income. As shown in Table 11, it is unlikely that this source of government saving has fully compensated for the reduction in personal saving. Only with Model 3, which estimates that public pensions have lowered personal saving by a modest 0.196 percentage points, is the reduction in saving compensated by the CPP/QPP surplus.

An additional consideration is Canada's open economy. If public pensions substantially reduce saving, then the resulting higher interest rates would attract capital inflows (foreign sector saving). In the extreme case of perfect capital markets, the reduction on domestic saving would be fully substituted by foreign saving, thereby insuring total saving, though different in mix, remains unchanged.

ESTIMATE OF NET IMPACT OF PUBLIC PENSIONS ON PERSONAL SAVING ADJUSTED FOR CPP/QPP SURPLUS, 1976 — TABLE 11

	Estimated Net Impact	CPP/QPP Surplus as Percent of Personal Disposable Income	Estimated Net Impact Adjusted For CPP/QPP Surplus
Model 1	-1.744	0.927	-0.817
Model 2	-1.576	0.927	-0.649
Model 3	-0.196	0.927	0.731
Model 4	-2.740	0.927	-1.813
Model 5	-1.623	0.927	-0.696
Model 6	-5.023	0.927	-4.096

VII. CONCLUSION

This paper has examined the impact public pensions in Canada have on personal saving. The overall statistical results support the hypothesis that public pensions have reduced personal saving. Depending on model specification, the magnitude of the reduction in the rate of personal saving is estimated to range from 0.196 percentage points to 5.023 percentage points.

The paper also estimated the impact of a 50 per cent increase in CPP/QPP retirement benefit. If the CPP/QPP and OAS programs are viewed as a single program, the increased retirement benefit would reduce the rate of personal saving by 0.729 percentage points. But if the OAS and CPP/QPP programs are assumed to be behaviourally distinct, it is estimated that a 50 per cent increase in the level of CPP/QPP retirement benefits would reduce personal saving by 2.407 percentage points.

It is emphasized that these results are based on rough parameter estimates whose magnitudes depend on model specification. Further, the variables used to estimate the impact for Canada's public pension system on saving are indirect and are undoubtedly imprecise measures of changes in social security wealth perceived by life cycle savers. For these reasons too much weight should not be given to numerical value of the estimates. What is important is their indication that public pensions do reduce personal saving.

APPENDIX A

DATA SOURCES

DATA SOURCES

1. Saving and income data and OAS, GIS, CPP and QPP benefit expenditures are from the National Income and Expenditure Accounts.

2. Dependency ratios and the coverage variable were computed from population statistics published by Statistics Canada. (Catalogues Nos. 91-512, 91-202 and 91-514).

3. Annual OAS, CPP, QPP retirement benefit levels were taken from The National Finances, published by the Canadian Tax Foundation.

4. The annual unemployment rate was derived by dividing the number of unemployed by the total civilian labour force as recorded in the National Income and Expenditure Accounts.

5. The RET variable, the percentage of males 65 and over not participating in the labour force, was derived from annual average participation rates published by Statistics Canada, Seasonally Adjusted Labour Force Statistics (71-201).

6. Where possible, data was retrieved through CANSIM.

FOOTNOTES

1. For a detailed explanation of the extended life cycle model, see Feldstein (1974a, 1974b, 1976).

2. This is not strictly true since the Spouse Allowance under Old Age Security legislation provides public pension benefits for individuals 60 years of age and over, providing they are the spouse of an individual aged 65 or over who is in receipt of OAS/GIS pension benefits.

3. Though federal and provincial governments have provided programs for the indigent aged prior to 1952, the programs were essentially welfare orientated and stigmatically administered. It has been assumed these programs did not affect saving behaviour. For a history of the changing attitude to public pensions in Canada, see Bryden (1974).

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